INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

SECRET

50X1-HUM

COUNTRY East Germany

SUBJECT 1. Miniature Tubes Developed by the WF Werk, Berlin-Oberschoeneweide
2. Summary of East German Processes for Transistor Manufacture

REPORT

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technical descriptions of the following miniature tubes developed by the VEB Werk fuer Fernmeldewesen WF, Berlin-Oberschoeneweide:

a. Double triode 6SL7GT (driver tube) : a modulator for power triode 829/B with a triode system and phase shift with the other triode system (but not push-pull stage). It was probably developed for the East German Army. Prototype production was to begin in January 1959. 50X1-HUM

b. Miniature modulator tube 6S7S : used as push-pull modulator or multi-purpose tube especially for marine radio in combination with transmitter tube 829, in which system the 6S7S is the modulator and the other the phase shifter. It was also probably developed for the East German Army. Prototype production was to begin in January 1959. 50X1-HUM

c. Miniature tube 3B4S : used in portable transmitting and receiving equipment of the East German Army and exported to the Soviet Union; also used as frequency multiplier. It was probably developed for the East German Ministry of National Defense. Prototype production was to begin in February 1959. The equivalent Western type is the USA 3B4, although the 3B4S represents a further development of the type. 50X1-HUM

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Manufacturing Processes Used for Germanium Transistors and Germanium Diodes.

(Brief Summary of Processes Used in the Preparation of Base Materials - Semiconductor Crystals - in the manufacture of Germanium Transistors and Germanium Diodes)

A. Germanium-Junction-Transistors.

Operation 1: Purification of the Raw Material. (This raw material is Germanium imported in the form of Germanite or obtained from countries with an extensive zinc processing plants where it is a side product.)

a) Chemical Conversion into Germanium-Tetrachloride

b) Ten-to thirty times distillation, depending on the quality of the germanium tetrachloride

c) Hydrolysis to change the tetrachloride into the dioxide

d) Reduction of the germanium-dioxide by way of hydrogen to germanium powder

e) The germanium powder is smelted into rods at 980°C.

Operation 2: The germanium rods are cleaned by the "zone melting process"

Limits of impurities: 10^{-5} to 10^{-8}%

Operation 3: The crystals are drawn and the intermediate layer (basis) is introduced.

a) Smelting of the germanium crystals in graphite-crucibles in the presence of buffer gas

b) Introduction of the monocrystal seed into the melt

c) Introduction of antimony (n-conductor) for the "doping" of the specific resistance required in each case.

d) After the crystal has grown enough, introduction of gallium (p-conductor) to over-compensate the n-conductor

e) After further growth of approximately 50 µm re-doping for the n-conductor until the basic crystal has grown to the required length.

Operation 4: The basic crystals are cut according to length and pieces needed. The cut surfaces are smoothed.

Operation 5: The gold-wire is attached to the basic electrode

Operation 6: The collector and emitter connections are attached and soldered.

Operation 7: Test field examination I.

Operation 8: Final Assembly including Surface finishing

Operation 9: Test field examination II

Operation 10: Aging process [~~decomposing~~]

a) Passage through the -40°C to + 60°C temperature cycle up to three times at a relative humidity of 90%, each cycle lasting 8 hours.

b) Accoustic irradiation during 30 seconds with 50,000 cycles.

c) Abrasive bombardment to enlarge the surface cross-section ((high intensity, mechanical-static shaking, packing and unpacking of the material in order to obtain at the same time a roughening of the surfaces for a better adhesion of the protective lacquer)

d) Passage through a -50°C to + 70°C temperature cycle - 8 hours each.

Operation 11: Test field examination III

Operation 12: Lacquer application to the surface and marking of the type

~~Operation~~ Definition of the proportions of foreign body additives - 10^{-3} to 10^{-6}%

E. ~~Germanium~~ Diodes

Operation 1: Same as for the ~~germ~~anium junction transistors

Operation 2: Same as for the germanium junction transistors

Operation 3: Mixing of the crystal melt with the optimum amount of the donor-foreign material required in each case

Operation 4: Melting (processing ?) into balls of determined sizes with "acute" hardening of the material.

Operation 5: Cutting the balls into halves with diamond saws.

Operation 6: ~~Joining~~ Soldering of the hemispheres without a boundary effect on a hard-silver plating carrier

Operation 7: Attaching the n-electrode

Operation 8: Activation Process with current densities up to 800,000 A/cm^2.

Operation 9: Final assembly and surface finishing.

Operation 10: Testfield examination I with shaking process at approximately 5 to 8 g depending on the type of material and construction.

Operation 11: Aging process ~~(decomposing)~~ (same as for the germanium junction transistor)

Operation 12: Testfield examination II

Operation 13: Lacquering of surface and marking of type

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~~process~~ includes - according to knowledgable scientists - some operations (especially Aging) which are not known and therefore not used in the West [redacted]

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